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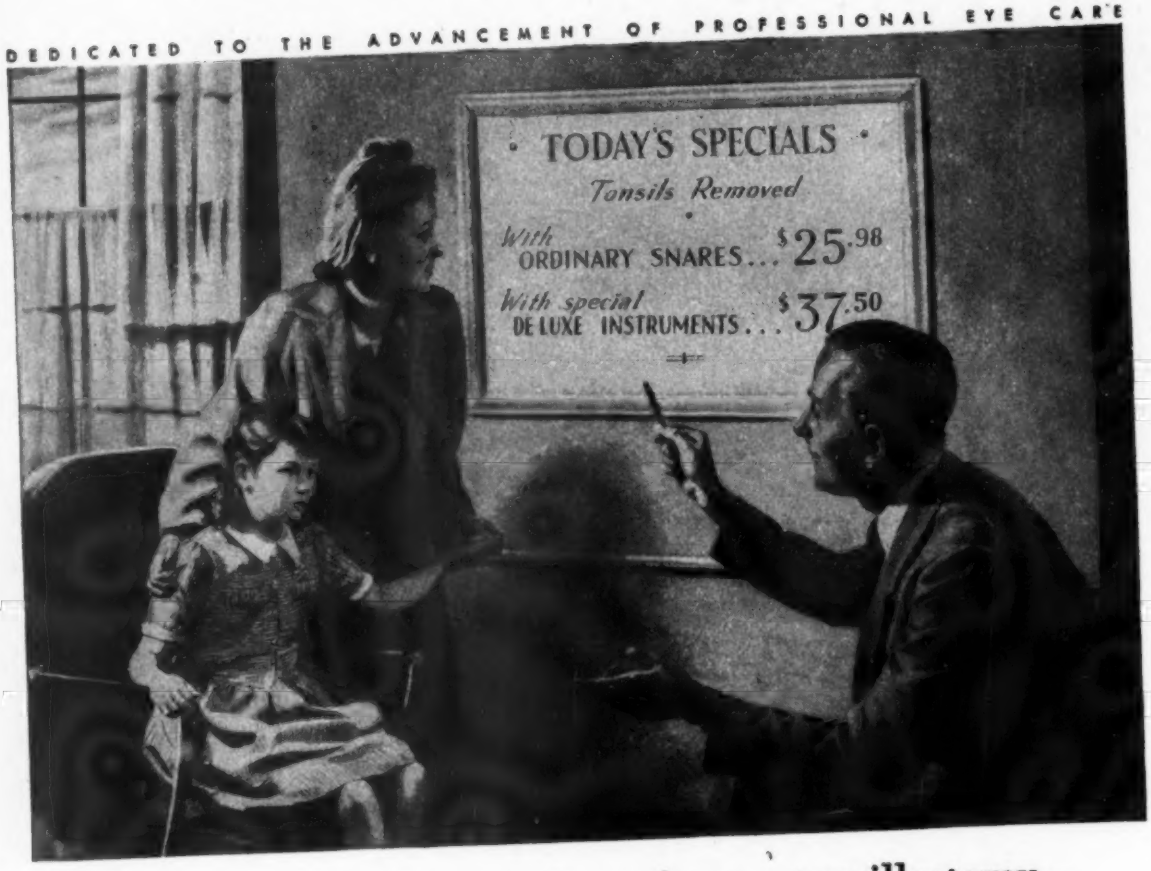

Instruments alone can't perform a tonsillectomy— nor glasses alone correct faulty vision

From The AMERICAN *Plan for Better Vision*

These professional services are worth infinitely more than the cost of the material in the glasses themselves.

EXAMINATION: Professional examination for possible pathological eye conditions.

REFRACTION: Scientific measure of your ability to see.

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You don't have to ask what's wrong with this picture. Thank goodness, doctors don't base their fees on the instruments they use.

Naturally, if your child's tonsils need to be removed, you seek the services of a skilled surgeon. The instruments he uses are important, but you know they're mere incidentals compared to his professional knowledge and training.

SEEK PROFESSIONAL ADVICE
— not glasses at a price

But are you as wise about your eyes?

At the first indication of eye trouble many people say to themselves: "Guess I'd better buy a pair of glasses." That's as illogical as placing surgical instruments above professional skill.

Glasses alone can never correct faulty vision. Actually, they are but incidental materials. What counts most is the professional skill and services that are available to bring you better vision.

So don't confuse the price of glasses with the cost of eye comfort. Glasses alone without professional eye care are *never* a bargain at any price. Go to your Ophthalmologist, Optometrist, Ophthalmic Dispenser for professional skill and services. Give your eyes the benefit of the professional skill and service that your priceless sight demands.

Invest in eye care — not glasses at a price.

American Optical COMPANY

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Yours The Problem - Ours An Opportunity To Assist

AO's educational messages currently appearing in *Life*, *Look*, *The Saturday Evening Post* and *Good Housekeeping* are written to assist you with your problem of educating the public to the true facts regarding professional eye care.

Illustrated on the opposite page is the eleventh in this long series of educational messages. It will appear for the first time in the *February 28 issue of Life* magazine.

Today there are too many people who think of glasses as merchandise. Giving little or no credit to the professional services, they confuse the price of glasses with the cost of eye comfort.

AO's full page educational messages are designed to help correct this public misconception of the true relation of glasses to eye care and visual efficiency.

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ANISEIKONIA—A CLINICAL REPORT COVERING A TEN YEAR PERIOD*

Robert E. Bannon and Wendell Triller
Dartmouth Eye Institute
Hanover, New Hampshire

I. INTRODUCTION

In 1915 Professor Ames began the research which led to the discovery and development of aniseikonia. His first paper[1] was published in 1921 but it was not until 1932 that the first *clinical* articles[2, 3, 4, 5] began to appear in scientific journals. During the past ten years many papers[6] have been published on the clinical, as well as the research phases of aniseikonia. The advances made during this period in the technique of measuring and correcting aniseikonia have been described in a previous paper[7]. The design and manufacture of lenses[8] correcting aniseikonia as well as ametropia have progressed considerably so that now practically all prescriptions can be made in unitary lens form. At the present time the research staff of the Dartmouth Eye Institute is completing work on methods of measuring aniseikonia, not only in the horizontal and vertical meridians, but also in oblique meridians, utilizing the effect on binocular space perception caused by differences in the relative size of the ocular images. These new tests promise to make the examination for aniseikonia simpler and faster; the equipment should be less expensive and require less space in the practitioner's office.

This report is primarily concerned with the practical results obtained by patients for whom aniseikonic corrections were prescribed during, approximately, a ten year period. While the theoretical aspects of aniseikonia are of interest to many, the busy practitioner is mainly concerned with the practical results obtained from a new method of treatment. One may, or may not, be impressed with theoretical argu-

*Submitted on March 10, 1944, for publication in the May, 1944, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

ments, but it is of practical and clinical importance to know whether proposed therapies benefit the patient.

There was a time when glasses were prescribed mainly to improve visual acuity in cases of myopia and presbyopia. It was Donders[9], who, in his admirable textbook dated 1864 pointed out: "It is a great satisfaction to be able to say that asthenopia need no longer be an inconvenience to anyone . . . The discovery of the simple fact that asthenopia is dependent on the hypermetropic structure of the eye, pointed the way it is to be obviated." Why does a young person with one diopter of hyperopia and ten diopters of accommodation, report relief from "eyestrain" and headaches when provided with corrective glasses? Why does another person with the same, or a greater amount of farsightedness have no discomfort without glasses? These and similar questions are difficult to answer. However, for all practical purposes, the average practitioner feels justified in prescribing hyperopic corrections, because his experience, based upon reports from patients, has shown that ocular discomfort has more often than not been relieved with these corrections.

The correction of hyperopia and the correction of aniseikonia for the relief of ocular discomfort are analogous in a clinical sense because both are dependent upon patients' reports to determine their effectiveness. The mass of evidence proving that aniseikonic corrections can be effective is slowly but steadily increasing.

II. Patients' Reports

More than five thousand patients have been examined for aniseikonia at the Dartmouth Eye Institute†. Of this number only half were given aniseikonic corrections; the other half were not given aniseikonic corrections for one or more of the following reasons:

a. The uncorrected refractive errors, heterophoria, poor fusional amplitudes, general health, or ocular disease were obviously more significant than the aniseikonia measured.

b. An insignificant amount of aniseikonia was measured.

c. The expense and/or appearance of the glasses, in the opinion of the patient, were more objectionable than his ocular discomfort.

Those patients who were given aniseikonic corrections and who wore their glasses for one year or longer, constitute a sizeable group from which a fair estimate of the value of the aniseikonic corrections

†There are about twenty other places in this country where aniseikonic examinations and corrections are also given: at least another five thousand patients have been examined. This report will refer to some of their results. (See references 10-14.)

may be obtained. For this purpose questionnaires* were sent to patients during the ten year period. These questionnaires were concerned only with the problem of whether or not the patient obtained visual comfort from his aniseikonic correction. The results tabulated from the questionnaires are shown in TABLE I.

TABLE I

Results from Questionnaires** Sent to Aniseikonic Patients

	1933-39	1939-42	TOTAL
No. of questionnaires sent.	1200	915	2115
No. of patients replying..	727 (100%)	685 (100%)	1412 (100%)
No. reporting substantial relief over previous Rx...	598 (82%)	557 (81%)	1155 (81%)
No. reporting no relief....	129 (18%)	128 (19%)	257 (19%)

In a study of this table it should be borne in mind that, in general, aniseikonic corrections were given only after careful refractive corrections and other necessary treatment had been given and no relief had been obtained. Of the 2115 patients given aniseikonic corrections and to whom questionnaires were sent, 1412 replied. Some of the questionnaires were returned because of "incorrect address," "whereabouts unknown," "addressee deceased," etc. No doubt, many did not reply because they obtained no benefit from their corrections. If the group who replied to the questionnaires is considered as 100% then the number reporting relief is 81%. However, if the total number of questionnaires sent is considered as 100% then the number reporting relief drops to about 55%. A fair figure of the percentage of patients who benefited by the aniseikonic correction would be between 55% and 81%. These figures correspond very closely to those given in previous papers by Doane[10], Berens[11], Fisher[12], Hughes[13], and Hicks[14]. The correction for aniseikonia is no cure-all. This is evident from the fact that 19% of the group who replied to the quesitonnaires stated that no relief from their symptoms had been obtained.

III. Symptoms

The symptoms reported by patients with aniseikonia are not very different from those of patients having uncorrected ametropia or neuromuscular anomalies. The crux of the matter—the fact which makes one suspect a patient may have aniseikonia—is that these symptoms persist *after* the careful correction of refractive errors and/or motor diffi-

*Appendix I illustrates the type of questionnaire used.

**The results from 500 questionnaires were reported in a previous paper—Relationships Between Aniseikonia and Ametropia—E. H. Carleton and L. F. Madigan. Arch. of Ophth., Aug. 1937, V. 18, No. 2, pp. 237-247.

DARTMOUTH EYE INSTITUTE
HANOVER, NEW HAMPSHIRE
DARTMOUTH MEDICAL SCHOOL

Address reply to
Clinical Division
DARTMOUTH EYE INSTITUTE
4 WEBSTER AVENUE

Date_____

We are conducting a survey of our patients who have been corrected for aniseikonia. Your cooperation will be appreciated and will assist us in evaluating clinical results which will give valuable information for our research work.

You may have reported to us or have been examined in recent months. We would still like to have you fill in your answers to the following questions.

Can we have your completed questionnaire at once?

Very truly yours,

(SIGNED)_____

1. **Are you now wearing your aniseikonic correction?** _____.
2. **To what extent have these glasses helped you? Check one of the following. Completely_____; partially_____; not at all_____.**
3. **If you discarded your aniseikonic glasses, please give the approximate date**_____

   Reasons (briefly) for doing so.

YOUR NAME _____

STREET ADDRESS _____

CITY AND STATE_____

(Use other side for comments, etc.)

culties. The following is a list of characteristic symptoms reported by patients who were referred for aniseikonic examinations.

TABLE II

Characteristic Symptoms Reported by 500 Patients Referred for Aniseikonic Examination

	Percentage of Patients
Asthenopia (local eye discomfort, such as fatigue, ache, pain, burning, pulling, tearing, etc.)	67%
Headaches (all types)	67%
Photophobia	27%
Reading Difficulty	23%
Nausea	15%
Motility Difficulty (diplopia, etc.)	11%
Nervousness	11%
Vertigo and Dizziness	7%
General (physical) Fatigue	7%
Functional Disturbances (subjective report of space perception difficulties)	6%

About two-thirds of the patients reported asthenopia and headaches. A person was considered to have reading difficulty if he maintained that he was a slow reader; could not concentrate well on reading or had difficulty in understanding what he read. No tests were made to evaluate the patient's claim of being a poor reader but his word or that of the referring teacher was accepted. For the purpose of classification, car sickness, seasickness, airsickness, and trainsickness were included under the general heading of nausea. It is not intended to imply that the symptoms recorded are necessarily due to ocular factors; they are mentioned merely because the patients reported them.

Some may consider it unusual that so few aniseikonic patients mention space perception difficulties especially since it has been demonstrated[15] that aniseikonia does affect the binocular judgment of objects in space. The explanation is simply that most patients are not aware of their anomalous spatial localization. The astigmatic person does not stress that his trouble is seeing some lines (or sections) of an object clearer than others, although it can be demonstrated *under the proper test conditions* that he does see clearer in some meridians. Aniseikonic patients, as well as astigmatic patients, are not usually aware of *how they see* but they are aware of their somatic symptoms of discomfort.

It is noteworthy that the majority of patients associated their symptoms with the use of their eyes for near work. This is to be expected because most of these patients were engaged in tasks which necessitated the use of their eyes at the near point. Furthermore, prolonged near point tasks usually demand more exacting and accurate vision than does far point seeing.

IV. Case Histories

It is always interesting to review actual cases; in fact, many practitioners obtain more information from the study of a few typical patients' records than they do from a mass of statistcal data.

Case No. 1. Miss C. A. U., court stenographer, age 29, was first seen in August, 1939. She had been wearing:

R.E. + 1.00 D.Sph. ⌒ — 0.75 D.Cyl. × 180
L.E. + 1.00 D.Sph. ⌒ — 0.50 D.Cyl. × 180
Add +0.50 D.Sph. O.U. in fitovers for near.

History and Symptoms: The chief symptoms were daily severe occipital headaches and asthenopia. The patient stated that she had been from one eye specialist to another and had had many prescriptions filled, none of which helped her. She had been under observation for ten days in a hospital and numerous physical and neurological examinations were made. One of the physicians on the hospital staff finally referred the patient to the Dartmouth Eye Institute. He reported: "Miss U. certainly has prostrating headaches; yet on physical examination she has almost nothing to account for them. Certainly she has nothing to suggest a brain tumor or anything of that nature. The neurological examination was entirely negative. X-rays of the skull revealed no abnormality. The various laboratory studies all were normal, including lumbar puncture which showed a normal protein consentration, normal dynamics, and normal collodial gold curve. The blood and spinal fluid both were negative serologically. The basal metabolic rate was normal."

Prescription: Our examination resulted in the following prescription:

R.E. + 1.25 D.Sph. ⌒ — 1.12 D.Cyl.×180 ⌒ 1.75% Mag.* × 180
L.E. + 1.00 D.Sph. ⌒ — 0.75 D.Cyl.×165

Report: The patient reported in January, 1940, that she had experienced no headaches after the first month with the new cor-

*Mag. = Magnification

rection. In November, 1942, in answer to our questionnaire, the patient again reported continued comfort in the use of her eyes.

Case No. 2. Dr. L. F., physician, age 45, was first seen in September, 1941.

History and Symptoms: Marked eyestrain in close work; dull pain in eyes; car and trainsickness; vertigo after close work. These symptoms had been relieved by an aniseikonic correction given elsewhere in 1936.

R.E. — 1.75 D.Sph. ⌒ — 2.00 D.Cyl. × 180 ⌒ ¾ △ B. down
L.E. — 1.75 D.Sph. ⌒ — 3.00 D.Cyl. × 5 ⌒ 1.50% Mag.×180

In *1939* the Rx had been changed to:

R.E. — 1.75 D.Sph. ⌒ — 2.00 D.Cyl. × 180 ⌒ ¾ △ B. down
L.E. — 2.00 D.Sph. ⌒ — 3.00 D.Cyl. × 5 ⌒ 1.50% Mag.×180
Add +0.75 D.Sph. O.U.

Prescription: In *1941* our Rx was as follows:

R.E. — 1.75 D.Sph. ⌒ — 2.25 D.Cyl. × 180 ⌒ ¾ △ B. down
L.E. — 1.75 D.Sph. ⌒ — 3.25 D.Cyl. × 5 ⌒ 1.50% Mag.×180
Add +1.00 D.Sph. O.U.

Report: It is interesting to note that over a five year period the aniseikonia has not changed and the slight change in the refractive correction is primarily what one would expect due to the presbyopia. Whenever the patient obtained a new aniseikonic correction he also had a pair of glasses made *without the aniseikonic correction*. He has therefore been able to compare the glasses with and without aniseikonia corrected. He has reported that he is much more comfortable with the aniseikonic correction. In answer to our November, 1942, questionnaire, the patient reported continued comfort.

Case No. 3. Mr. L. H. M., salesman, age 44, was first seen in July, 1937. He had been wearing:

R.E. + 3.25 D.Sph. ⌒ — 0.50 D.Cyl. × 7
L.E. + 3.50 D.Sph. ⌒ — 0.75 D.Cyl. × 170
Add + 0.75 D.Sph. O.U.

History and Symptoms: Eyes feel "bruised" after reading, movies, and driving; photophobia; frontal headaches; occasional nausea. Symptoms had been present since childhood despite the best ophthalmological care, including orthoptics.

Prescription:

R.E. + 3.00 D.Sph. ⌒ — 0.50 D.Cyl. × 5 ⌒ 1.50% Mag. × 180

L.E. + 3.50 D.Sph. ⌒ — 0.75 D.Cyl. × 170 ⌒ 0.75% Mag. × 90
Add + 0.75 D.Sph. O.U.

Report: *July, 1940*: Patient wore the aniseikonic correction for over two years and enjoyed complete relief from his symptoms. The iseikonic lenses became scratched and on the assurance by an optical firm in California that his glasses could be duplicated he had a new pair made. He had worn these several months believing they were the same as his iseikonics and he could not understand why he was uncomfortable; all his former symptoms had returned. He came back for a recheck and it was found that the glasses made in California corrected his refractive error only.

Our re-examination resulted in substantially the same correction as in 1937:

R.E. + 3.00 D.Sph. ⌒ — 0.50 D.Cyl. × 5 ⌒ 1.00% Mag. × 180
L.E. + 3.25 D.Sph. ⌒ — 0.50 D.Cyl. × 160 ⌒ 0.50% Mag. × 90
Add + 1.25 D.Sph. O.U.

September, 1940: Patient wrote: "My new glasses are certainly giving me relief and I feel like a new man."

November, 1942: In answer to our questionnaire, the patient reported that he was still comfortable.

Case No. 4. Mr. C. K. G., physicist, age 47, was first seen in August, 1941. He had been wearing:

R.E. + 1.00 D.Sph. ⌒ — 0.50 D.Cyl. × 180
L.E. + 1.25 D.Sph. ⌒ — 0.25 D.Cyl. × 180

History and Symptoms: Reading more than one hour caused frontal headaches and asthenopia. For the past five years reading with one eye occluded was much more comfortable.

Prescription:

R.E. + 0.75 D.Sph. ⌒ — 0.50 D.Cyl. × 175 ⌒ 0.50% O.A.* Mag.
⌒ 1.50% Mag. × 90

L.E. + 0.75 D.Sph. ⌒ — 0.37 D.Cyl. × 180
Add + 0.75 D.Sph. O.U.

Report: During the past two years the patient has written us several times (the last letter dated April 26, 1943) that he has been very comfortable with the aniseikonic correction. He mentioned that he had been able to carry a full teaching load and

*O.A. = Overall

do war field work on the side to the extent of twenty-four hours overtime per week.

Case No. 5. Mr. A. W., writer, age 65, was first seen in June, 1937. He had been wearing:

R.E. + 1.37 D.Sph. ⌒ — 0.75 D.Cyl. × 160
L.E. + 2.25 D.Sph. ⌒ — 1.25 D.Cyl. × 5
Add + 2.25 D.Sph. O.U. for near.

History and Symptoms: For the past thirty years headaches associated with the use of the eyes, especially for near work. Complete physical and neurological examinations had been negative. Numerous pairs of glasses prescribed by the best eye specialists had not relieved the headaches.

Prescription (1937):

R.E. + 1.37 D.Sph. ⌒ — 0.75 D.Cyl. × 164 ⌒ 2.50% Mag. × 90
L.E. + 2.25 D.Sph. ⌒ — 1.25 D.Cyl. × 3
Add + 2.25 D.Sph. O.U. for near

Report: Marked relief from the severe headaches and increased ability to do near work.

Prescription (1940):

R.E. + 1.37 D.Sph. ⌒ — 0.62 D.Cyl. × 163 ⌒ 0.50% O.A. Mag ⌒ 2.00% Mag. × 90
L.E. + 2.25 D.Sph. ⌒ —1.25 D.Cyl. × 8
Add + 2.50 D.Sph. O.U. for near

Report: In answer to our questionnaire (November, 1942) the patient wrote: "I would honestly and genuinely not take a cold million dollars for my lenses. Had I had them thirty years ago I would have written half a dozen books which did not get written."

Case No. 6. Mrs. A. F., a housewife, age 28, was first seen in November, 1939. She had been wearing:

R.E. + 1.12 D.Sph. ⌒ — 1.12 D.Cyl. × 180
L.E. + 0.50 D.Sph. ⌒ — 0.50 D.Cyl. × 177

History and Symptoms: The chief symptoms were severe frontal headaches for the past ten to twelve years. The headaches occurred on an average of two to three times per week but sometimes daily, and were occasionally followed by nausea. Thorough

neurological investigations had not revealed any basis for the headaches.

Prescription:

R.E. + 1.00 D.Sph. ⌒ — 1.00 D.Cyl. × 180 ⌒ 1.00% O.A. Mag.
L.E. + 0.75 D.Sph. ⌒ — 0.50 D.Cyl. × 15

Report: After two months the patient reported almost complete relief from the severe headaches and four months later the referring physician wrote us: "I have been very pleased with the result of your treatment of aniseikonia on Mrs. A. F. whom you examined last November. The girl is absolutely a new person. If such minor degrees of visual disturbances can give as severe symptoms as that girl had, there is something radically wrong with the routine eye examination which fails to find such disorders."

In answer to our 1942 questionnaire the patient stated: "Aniseikonic glasses have cured me of what was once called a 'possible migraine' headache. I wear my glasses constantly and I have worn the aniseikonic correction for three years . . . I would say my health has improved. Dr. J. F., my physician, is very pleased."

V. Summary and Conclusions

We have presented data which show that the correction of aniseikonia has been helpful in over 80% of the 2115 cases that have worn their corrections for a period of one year or more and have answered our questionnaires. Most of the patients reporting had worn their corrections more than two years. It may not be infallible to conclude—that because a patient's symptoms disappear the only cause must have been that for which the specific treatment was given. Nevertheless, the fact that a preponderant number of patients report relief from long-standing symptoms following a specific treatment, when other treatments had failed to bring relief, indicates at least a good possibility that the type of treatment which did give relief was effective. Even Donders[9] (pp. 274-275) points out that despite the notions of science relative to therapeutics—"the final decision must remain with empiricism." The "rational" treatment by eye specialists should be concerned with relieving symptoms of discomfort regardless of whether or not their comprehension of the "means whereby" is in agreement with the theories they learned as dogma in their academic education.

The incidence of various symptoms and their relative occurrence

in distant or near vision is presented. It is pointed out that the symptoms of which aniseikonic patients complain are similar to those relieved by refractive and/or prismatic corrections but what makes one suspect the presence of aniseikonia is the persistence of these symptoms even after the best ametropic and motility corrections have been tried. Other clues suggesting aniseikonia have been discussed in previous papers[16, 17].

Finally, six typical case histories are presented to illustrate the type of patients included in our statistics. As is evident from these examples, the patients given aniseikonic corrections are those who have had long-standing symptoms despite the best medical and ocular care. Most of these patients have had numerous refractive prescriptions, orthoptics, physical and neurological investigations. They had been advised to have the aniseikonic examination as "a last resort." As Dr. Lawrence Post of St. Louis, Mo., wrote[18]: "Thus the aniseikonic clinics have become the rendezvous of the most difficult patients for whom to obtain comfort. That anything good is accomplished for these patients is the miracle."

There was a time, a hundred years ago, when only myopia and presbyopia were commonly corrected. Then, due to Donders and others, it became common practice to prescribe corrections for the relief of *discomfort* as well as for a visual handicap. For more than fifty years eye specialists have considered that, besides pathological anomalies, the defects requiring corrections were refractive and motility errors. During the past ten years clinical evidence has shown that another anomaly, aniseikonia, must be considered in the investigation and correction of those patients who do not experience relief by ordinary means. As Dr. Lancaster[19], quoting Nicholson, states: *"When a tradition once becomes established by the hallmark of acknowledged authority, it takes more than cold facts to uproot it from men's minds—it takes time."* Will it take another fifty years for the average eye specialist to realize the practical, or therapeutic importance of aniseikonic corrctions?

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ACCOMMODATION AND ITS RELATIONSHIP TO CONVERGENCE*

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In a previous article (1) our work on the nervous control of accommodation has been described. This paper will deal with our work on accommodation, accommodative-convergence, and convergence as measured on the haploscope.

Every optometrist knows from his work that the functions of accommodation and convergence must be related in some way. The first accurate observations of this relationship were made by Donders who wrote—" . . . the state of accommodation of the eyes corresponds to a definite convergence of the visual lines."[1] He also taught, however, that this "connection is not absolute and casual," but "that there is a certain degree of independence." One of Donders' pupils, Landolt (3), pointed out even more forcibly the independence of the two functions as conceived by Donders, "The fact that we can see, distinctly and simultaneously, with both eyes an object situated at an invariable distance, in spite of glasses which necessitate a change in accommodation, is proof positive that the relation between the latter and convergence is not absolute; and in fact, equally easy to demonstrate, that such glasses cannot exceed certain degrees, proves that the independence of the two functions exists only within certain limits."[2] Donders coined the term "relative" to describe the amount of convergence free from accommodation and the amount of accommodation free from convergence.

It was not long before some or even all of the concepts of Donders and his school were challenged. Maddox (4) came to the conclusion that the two functions are very closely related and that accommodation plays the major role. "The efforts of convergence and accommodation are intimately intersusceptible, so that the slightest impulse to either makes a difference in the other, albeit the difference is not necessarily equal in amount."[3] "In ordinary binocular vision there is a perfect concert between accommodation and convergence, so that the two visual

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[1]Donders, p. 110.
[2]Landolt, p. 199.
[3]Maddox, p. 83.

axes meet at whatever point is accommodated for."[4] He found that convergence was influenced by four factors in directing the visual axes to the point accommodated for. These are:

1. A tonic factor due to the ordinary tonicity of the extra-ocular muscles.
2. An accommodative factor.
3. A convergence factor due to "knowledge of nearness."
4. A fusion convergence factor.

Of these four factors, only the second or accommodative-convergence is influenced by accommodation. On the other hand, Maddox felt that convergence, for example, had no direct influence on accommodation. In other words, any change in accommodation always necessitates a change in convergence, but a change in convergence does not always necessitate a change in accommodation. In the opinion of Maddox, relative accommodation as postulated by Donders and Landolt does not exist.

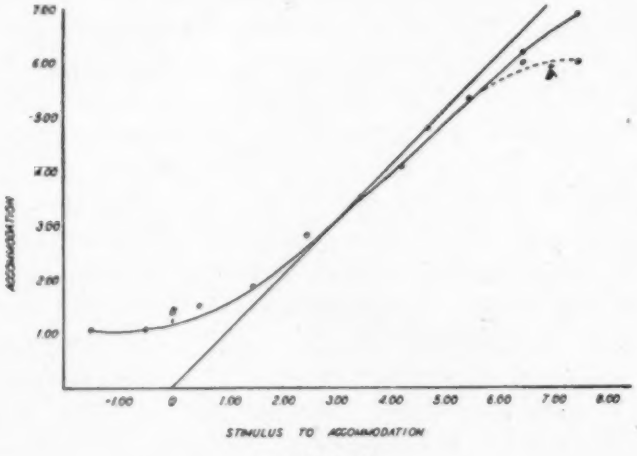

Figure 1

Since the time of Maddox nearly every possible viewpoint with regard to these factors has been taken. Cross (5), for example, denied the existence of relative convergence and negative relative accommodation Kletzky (6) maintained that there must be negative relative accommodation, but no positive relative accommodation. Bestor (7) interpreted his findings much as did Maddox, "There are excellent physi-

[4]Maddox, p. 86.

ological reasons for relative convergence . . . There is no such condition as relative accommodation . . . "[5]

There have been a number of investigators who have denied both relative convergence and accommodation. Among these the most accurate and by far the most impressive are found Ames and Gliddon (8). As a result of their work, they came to the conclusion, "The relation between the accommodative condition and the vergence condition is definite and fixed. (1) The vergence of the eyes is changed by changing the accommodative condition. (2) The accommodative condition of the eyes is changed by changing the vergence. (3) There is no relative accommodation. (4) There is no relative convergence."[6]

Stevens (9), Roelofs (10), Grim (11), and Maxwell (12), while not denying there is any relationship between accommodation and convergence, do deny that there is any physiological connection between the two functions. They conceive it to be an association due to experience alone, a conditioned reflex of a sort.

Fox (13) claimed that there was no relationship at all between the two functions. "Our comment would be that they seem to indicate that accommodation has little to do with binocular fixation and binocular fusion."[7] Even more startling is the claim of Hoessler (14), (15), who claims that positive accommodation is related to negative relative convergence.

Aside from Ames and Gliddon most of the careful modern investigations into this relationship between accommodation and convergence have been done by Sheard (16), Tait (17), and especially Fry (18, 19, 20, 21). Sheard came to about the same conclusions as did Maddox. Tait thinks that accommodative-convergence and positive relative accommodation are directly related so that positive relative accommodation may be safely predicted from the accommodative convergence. Fry's conclusions may be summed up in his own words, " . . . the width of the zone of play is determined solely by positive and negative fusional convergence which are independent of change in accommodation."[8] Thus Fry along with Sheard agrees essentially with the concepts of Maddox.

In this investigation of the relationship between the functions of accommodation and convergence, the haploscope was used to aid in the determination of the state of accommodation and convergence. For a

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[5]Bestor, p. 223.
[6]Ames and Gliddon, p. 59.
[7]Fox, p. 110.
[8]Fry, Amer. J. Optom., p. 333, 1939.

description of the haploscope the reader is referred to the papers of Ames and Gliddon (8), and Fry (18, 19).

The subjects for the experiments reported in this section were fifty college students between the ages of 20 and 30 years. All of them reported that they could use their eyes at near work as long as they cared to without objectionable subjective symptoms.

When relative accommodation for different distances was measured, targets of such size were used that the detail subtended an angle of one minute of arc at the entrance pupil of the eye. With the position of the target maintained constant, accommodation was varied by the use of lenses. The point conjugate to the retina was determined by finding the position at which two lights, 0.1 mm. in diameter, were seen most distinctly. Convergence was changed by prisms and measured by changing the angle between the two arms of the haploscope.

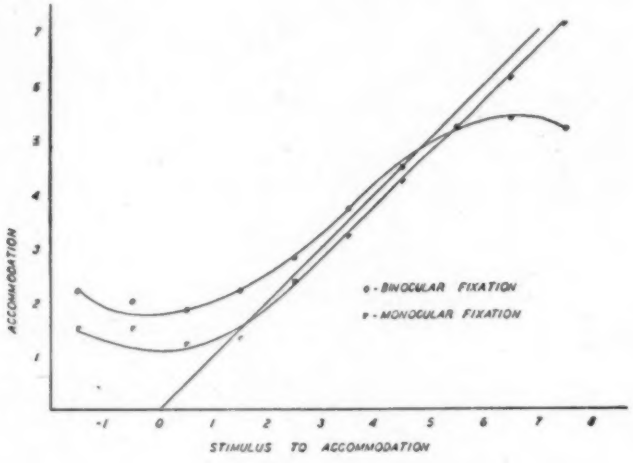

Figure 2

The methods of measurement used were found to be repeatable within ± 0.10 D. in accommodation and within $\pm 0.5\triangle$ in convergence.

Measurements were made on relative convergence, relative accommodation, supplementary convergence (phoria) and fixation disparity at the following fixation distance: 5 M, 1 M, 50 cm. 40 cm. 33 1/3 cm. and 25 cm. Measurements of the accommodative state were made both binocularly and monocularly.

In all cases the measurements of relative accommodation gave very similar results as shown by a typical example in Figure 1. In this figure,

the diagonal line represents the so-called "Donders' line" indicating a direct 1 to 1 relation between accommodation and its stimulus. Values above this line indicate that the subject was relatively myopic to the conditions and those below that he was hypermetropic. At the negative or lower end of the curve it can be seen that accommodation approached an asymptote of approximately 1.00 D while at the positive end two curves are shown. These two curves show that two sets of values were obtained. As the stimulus to accommodation increased, the subject at stimulus values of 6.50 D and 7.50 D found it very difficult to maintain clear vision. The solid part of the curve indicates values obtained when vision was clear, while the dotted part shows values when vision was not clear. The points at which the subject noticed the target to be blurred are shown by the letter "B."

The outstanding characteristic of the curve is the very definite asymptote at the negative end of the curve; regardless of the stimulus there was always apparently at least 1.00 D of accommodation on play. The actual value of this asymptote varied from individual to individual. The greatest value being 1.50 D and the least 0.50 D. The average value being 0.75 D. A similar asymptote seems indicated, but is not as definite for the positive end of the curve. Here there were great individual differences with some subjects showing a definite asymptote while others did not. As the limit of positive accommodation was reached, the apparent behavior of accommodation became erratic, sometimes the necessary effort was made and at other times it was not made. Where definite limits could be ascertained they varied from 4.40 D of accommodation to 7.00 D.

Another fact easily ascertained from inspection of Figure 1 is that blurring for this subject did not become apparent until the accommodation lagged behind the stimulus about 1.00 D; in one instance, 1.25 D myopic and in the other 1.00 D hypermetropic. All subjects exhibited this wide depth of focus, the average being about 0.75 D.†

One is at once tempted to speculate that this tendency for accommodation to be limited is due to the influence of convergence. For example, as accommodation is inhibited, then accommodative-convergence is decreased, and if single binocular vision is to be maintained then positive relative convergence must be exercised. This process could then be continued until either the limits for the inhibition of accommodation has been reached or the limit of positive relative convergence is reached. Since

†Values stated to the nearest 0.25 D. step.

it would appear that there is at least 1.00 D of accommodation in force, obviously at the asymptotic point for negative relative accommodation it must be that accommodation is not the limiting factor, but that convergence is.

This hypothesis was easily tested by repeating the measurements with only monocular fixation, thus eliminating the direct influence of relative convergence. The data thus obtained for both binocular and monocular fixation is shown in Figure 2.

This figure shows that at the negative end of the curve the two sets of data follow a similar course and that for this subject at least, the limiting action of negative relative convergence could only be the difference between the two curves or approximately 0.75 D. These curves represent the maximum difference obtained in all measurements. The values varying from 0.0 D to 0.75 D, averaging between 0.25 D to 0.50 D.

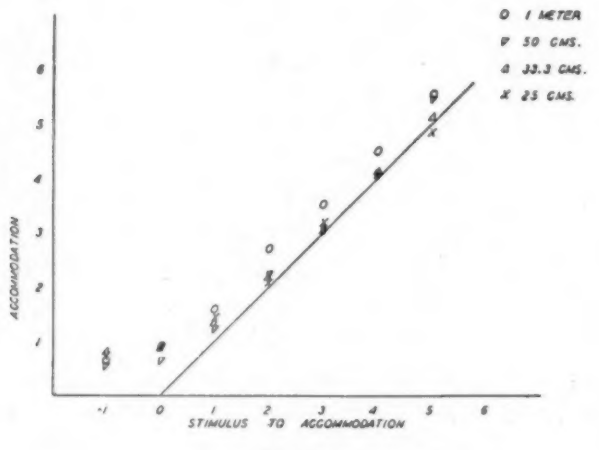

Figure 3

One limiting factor that could be operative on both monocular and binocular measurements is the influence of the subject's awareness that the targets used for fixation were near to him and thus he would be prevented psychically from inhibiting all of his accommodation. That this cannot be the whole answer can be seen in Figure 3. This figure shows the plot of negative accommodation taken at different distances. If accommodation is held by the subject's awareness of the nearness of the target, then the nearer the target the more accommodation should be

held. Strictly speaking, this curve shows no accommodation due to the nearness concept. If it shows anything, it indicates that relatively less accommodation is in use at 25 cms. than at 1 M. Hofstetter (25) was also unable to demonstrate any nearness effect on accommodation.

Another possible explanation is that offered by Luckiesh and Moss (22) in a recent series of papers. Briefly their idea is that the true "emmetropic" eye is really one that is approximately 0.75 D myopic and that negative relative accommodation is used in viewing distant objects. This offers a ready explanation for the 0.75 D asymptotic limit except for the fact that if negative relative accommodation can be used at distance to maintain sharp vision, why cannot it be used for near fixation?

The work of Luckiesh and Moss gives a clue to one influence on the focusing mechanism that has yet to be taken into account. This is the influence of spherical aberration. While they, Luckiesh and Moss, thought that negative relative accommodation allows the eye to focus it is much more likely that it is spherical aberration that enables the eye to see clearly.

Gullstrand (23) was the first to point out the effect of spherical aberration on the image formation of the optical system of the eye. He thought the eye was focused so that the brightest area of the conoid was focused upon the retina. For this reason the so-called "Gullstrand Eye" is 1.00 D hypermetropic for paraxial rays. In addition to Gullstrand, Ames and Proctor (24) have made measurements of spherical aberration on two subjects. The amount of the aberration was less as measured by them than as calculated by Gullstrand. They also found that the eye was generally focused so that the smallest diameter of the conoid formed by the yellow-green region of the spectrum fell upon the retina instead of the brightest area.

In the haploscopic measurements reported in this paper, the subjects focused two small bright lights upon the retina. This was done by finding the location of the lights when their apparent diameter was the smallest. Thus, this always placed the conoid so that its smallest diameter fell upon the retina. Since, in the middle range of these measurements, as can be seen in Figures 1, 2 and 3, the values found fall near the Donders' line, it can be assumed that the waist of the conoid falls upon the retina. As convex lenses are added the eye becomes progressively more myopic or hypermetropic as concave lenses are used. This indicates that the whole conoid is moved forward with convex lenses or backward with concave lenses near the limits of the change in accommodation, since we are locating with the two small lights of the haploscope the area of least

diameter of the spherical aberration figure. However, the subject does not appreciate any blurring of the target when this central area falls off the retina. In fact this blurring is not reported, until as mentioned above, this departure amounts to about ±0.75 D. Thus, apparently the eye can use an appreciable length of the caustic for the purposes of seeing. It is interesting to note that this also offers an explanation for the phenomena reported by Luckiesh and Moss.

When this effect of spherical aberration is added to the measurements of the limit of negative relative accommodation, the value obtained is very close to 0.00 D of accommodation. For example, in Figure 1, the asymptotic value of accommodation is 1.00 D and the place where blurring occurred is 1.20 D of myopia. When these two are added, the value approximates zero. In Figure 2, the asymptotic value is approximately 1.85 D while blurring occurred at the same point. Again the

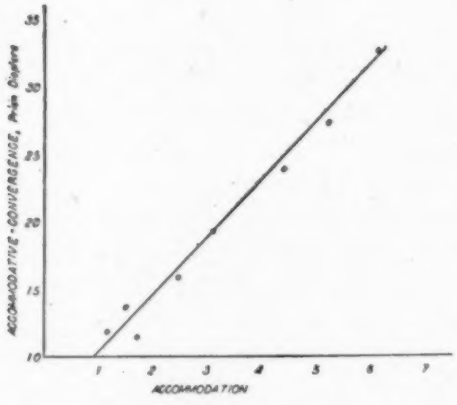

Figure 4

resultant is near zero. In all measurements on all subjects the addition of these two factors amounts to 0 ± 0.23 D.

Luckiesh and Moss found that for distant vision the eye was myopic to the extent of 0.75 D on the average for "emmetropic" subjects. This value agrees exactly with the average obtained here. The eye then apparently makes good use of its depth of focus in conjunction with the accommodative function.

Thus we see that even though negative accommodation appears to reach a limit above zero, but as far as vision is concerned, the limit is

zero. The asymptote at 0.75 D is due to the method of measurement. Actually, it is possible to inhibit with convex lenses the total amount of effective accommodation. Measurements made with the haploscope for a 6 M. distance give results similar to those found by the method of Luckiesh and Moss. Ames and Gliddon report similar data.

Very little has been said about the positive limits of relative accommodation. Here the retarding influence of convergence seems to be much more apparent. Since there is a marked difference between the limits of this function as found binocularly and monocularly.

With the haploscope it is also possible to measure the amount of convergence in use not associated with fusion for difference values of accommodation. This can be done in several ways, but the method used was to cut off the view of the fixation target from one eye. The small lights, however, used for the measurement of accommodation were still visible to this eye. The arm carrying these lights was then rotated until they appeared to coincide with a small line drawn on the fixation target. The amount of this rotation was then noted in degrees and later converted into prism diopters since this is the more familiar unit of measurement to most optometrists. A typical example of these measurements is shown in Figure 4.

In Figure 4 the actual amount of accommodation as measured on the haploscope is plotted against the values of convergence, found not to be associated with fusion. It is important to note that the actual values of accommodation are used and not stimulus values. It will, at once, be noted that these values fall upon a straight line showing a constant value for the accommodative-convergence accommodation ratio over the whole range of change of accommodation. For this subject this factor has a value of 4.2△ for each diopter of accommodation as calculated by the method of least squares. The average was 4.0△ ± 1.5△.

From such data as this it is apparent that Maddox's concept of proximal convergence is correct. For example, for the subject whose data is given in Figures 4, at 2.50 D of accommodation there is 16.5△ of convergence not associated with fusion. This subject manifested 2△ of esophoria as measured at 6 M. He also required 18△ of convergence at 40 cms. to have single binocular vision, thus making it necessary for fusion to supply 1.5△ of convergence. It is apparent that the accommo-

dative-convergence in force for 2.50 D of accommodation is 2.5 × 4.2 or approximately 10.5△. These added together as

Tonicity	2 △
Accom-Convergence	10.5△
Fusional-Convergence	1.5△
	14△

indicate that 4△ of convergence must be supplied from some other source not accounted for, which can be called proximal convergence.

Ten subjects manifested 0△ of proximal convergence. The largest amount was 7△ while the average was 3△ ± 2△.

Hofstetter (25) made measurements of accommodative-convergence and proximal convergence using different methods of measurement, especially for proximal convergence. He found that accommodative-convergence averaged 4.5△ ± 2.0△ for each diopter of accommomation and that proximal convergence had a value of 2.1△ ± 1.6△

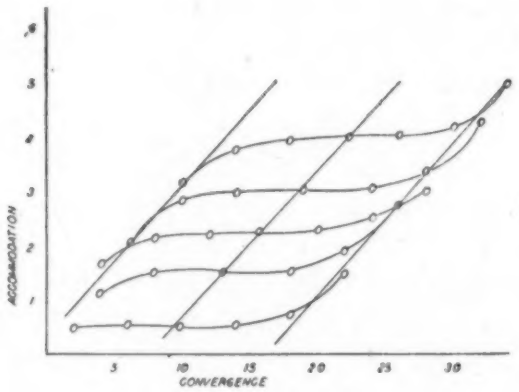

Figure 5

The measurements on relative convergence were made by changing convergence by means of prisms rather than by rotating the arms of the haploscope as Ames and Gliddon and Fry have done. This method was used so that the results might be more comparable to those obtained in the same measurements made clinically. For each change in convergence the state of accommodation was determined in the same manner as reported above for relative accommodation.

The results obtained on one subject are shown in Figure 5, where convergence in prism diopters as plotted against accommodation. In general four types of measurements resulted:

(1) Some subjects manifested changes in accommodation before diplopia occurred at both the positive and negative ends of the curve.

(2) Some subjects manifested changes in accommodation at the positive end, but diplopia occurred first at the negative end.

(3) Some subjects manifested changes in accommodation at the negative end, but diplopia occurred first at the positive end.

(4) Some subjects had diplopia at both ends of the function before accommodation changed.

All four categories have one feature of importance in common and that is the fact that if changes do occur in accommodation it is only near the limits of the function. Throughout the central area no significant changes occur in accommodation. It is also important to note that the asymptotic values for both positive and negative relative convergence are parallel and that these limits are not only parallel to each other, but also parallel to the central line representing accommodative-convergence. This means that when the limit of true relative convergence is reached and accommodation is brought into play the amount of change in convergence is exactly the same as the change in accommodative-convergence, thus showing that the additional convergence beyond the limits of relative convergence is supplied by accommodative-convergence.

This last observation is important since it shows that it is not convergence that stimulates accommodation. There is no evidence here of so-called convergent-accommodation. Thus the data here agrees essentially with the concepts of Maddox and Fry.

Ames and Gliddon (8) not only denied the existence of relative accommodation, but they also denied the existence of relative convergence. They did this largely because of the appearance of a phenomena they then termed "retinal slip," but now termed "fixation disparity." This is manifested on the haploscope by a change in position of the measuring lights on the target even with binocular fixation. This shows that the visual lines change their direction slightly, thus fixation disparity is similar to phoria except that binocular fixation is maintained. The subject does not experience any blurring of the target. Some trained observers, however, report that when esophoric disparity occurs the

measuring light appears slightly in front of the fixation target and with exophoric disparity the reverse is true.

Fixation disparity changes when either accommodation or convergence is changed. However, if this were to rule out relative convergence as a function the change in disparity should be proportional to the change in convergence. This is not the case. Fixation disparity tended to become esophoric when positive convergence was stimulated, and exophoric with negative convergence, but this was the only relationship. Just as the eye has a depth of focus for accommodation, it has a width of fusion for convergence.

From the data that has been presented in this paper it is possible to draw the following conclusions:

(1) There is no such thing as relative accommodation if a strict definition of the term relative is to be used, since even the smallest change in accommodation causes a change in convergence.

(2) If we merely define relative accommodation as the amount of change possible in accommodation for a fixed amount of total convergence, then there are certain limits imposed by
   (a) relative convergence
   (b) depth of focus
   (c) limits of accommodation

(3) Convergence is a complex function made up of four parts:
   (a) tonicity
   (b) nearness concept
   (c) accommodative-convergence
   (d) fusional convergence

(4) Accommodative-convergence varies directly with accommodation over the whole range of change in accommodation.

(5) Relative convergence exists in the strictest sense of the word.

(6) There is no convergent-accommodation. Blurring occurs when positive or negative convergence is stimulated because accommodative-convergence is activated.

(7) The eye is able to utilize spherical aberration to give it a greater depth of focus.

(8) The psychic influence of the subject's awareness of the nearness of objects has little influence upon accommodation, but it does influence convergence.

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A SINGLE JUDGMENT TEST FOR RED-GREEN DISCRIMINATION*

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Material developed for other ISCC committee work[1] provided two series of small-step chroma differences in hues designed to confuse the observer who makes errors of the typical protanope and of the typical deuteranope in accordance with available data, chiefly those published by Pitt.[2] The series extend from Munsell N 5/ in 40 steps of saturation to 6 R 5.4/4 for the protanope series, and in 40 steps of saturation to RP 5.0/4 for the deuteranope series. The material is in the form of metal chips, $1\frac{1}{4} \times 1\frac{1}{2}''$, the color baked on an enamel surface, the pigments used being as permanent in color as any that are known.

Several forms of simple screening tests using this material have been developed, but in early stages of the work representatives of the Armed Forces insisted that a satisfactory test could have no loose parts. The material has been tied down therefore to a fixed mechanism (Figs. 1 and 2). In this device 20 pairs of chips are mounted juxtaposed on a disk 15″ in diameter. The mask has two openings, one at the left, one at the right, each of which exposes one pair of chips at a time. The subject is asked to indicate whether the left chip of a pair or the right chip is the redder. In the model illustrated the subject needs only to press a left button or a right button, thus avoiding the possibility of confusing right and left, and in the Navy model a shutter over the chips automatically exposes each pair for a given number of seconds. The effect of having two openings in the mask is that 40 judgments are obtained from 20 pairs of chips, and that the right-left position of the members of each pair are taken into account.

The color of illumination is highly critical for color vision tests, therefore standard artificial daylight (Macbeth) in the color temperature range of 6700°K-7500°K has been made a part of this test device.

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*This paper is part of a symposium on Color Blindness and Color Blindness Tests arranged for the March 4-6, 1943 meeting of the Optical Society of America, by the Inter-Society Color Council. From the Journal of the Optical Society of America. Vol. 33, No. 9, pp. 512-514. 1943.

†Chairman of the Inter-Society Color Council Committee on Development of a Red-Green Discrimination Test.

[1]Forrest Lee Dimmick, J. Opt. Soc. Am. 32, 745(A) (1942).

[2]F. H. G. Pitt, Med. Res. Council (Brit.) Special Report Series No. 200 (1935); F. H. G. Pitt, Proc. Phys. Soc. 14, 219-244 (1942).

Illumination as low as 10 ft.-c seems to be satisfactory, but since this requires that the test be administered in some sort of a dark room, it is more feasible, in order to maintain test conditions in a room only partially darkened, to use a higher illumination. Much of the present test work is being done, therefore, with illumination of 20-60 ft.-c. Illumination differences in the range between 10 ft.-c and 60 ft.-c do not seem to be critical.

During the first several months of work on this test (February, 1942-October, 1942) our cooperating members used somewhat diverg-

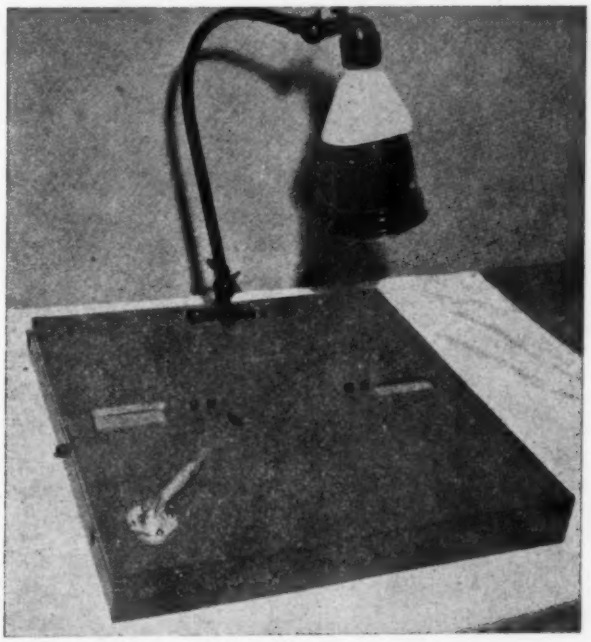

Fig. 1. One model of ISCC red-green discrimination test, ready for testing.

ent forms of the test and test procedure. In October, after studying the results, it was decided to adopt standardized test procedure. Since that time the data collected by most of the committee members have been in accordance with standard instructions. The order of size of color difference, of right-left, of protanope and deuteranope chip pairs, is now random. A standard "warming-up" procedure has been adopted: The subject reads a card of instructions on which sample pairs are shown. Thus all subjects get identical instructions; there should be no necessity for verbal instruction.

The Pitt chromaticity confusion lines of the typical protanope and deuteranope, transferred to the I.C.I. (x, y) diagram, are illustrated in Figs. 4a and 4b from a previous article by Judd.[3] A portion of this diagram with the protanope and deuteranope lines is illustrated in Fig. 3, the heavy line representing colorimetric data for the materials used in this test.

Tests made preliminary to standardization included a series on 57 near-normals (seamen of the British Navy) tested at the Ophthalmological Institute of the Presbyterian Hospital, 29 color-deficients tested

Fig. 2. Inside view of model in Fig. 1 showing paired chips in place on moveable disk.

at Hobart College, 396 men tested by the Navy, a general population of recruits for Air Corps cadets plus a few known color-deficients, 10 color-deficients tested at Randolph Field, and 6 color-deficients tested at the United States Department of Agriculture. Since standardization,

[3]Deane B. Judd, J. Opt. Soc. Am. 33, 305 (1943).

we have assembled tests made on color-deficients at the Ophthalmological Institute, at Hobart College, and by Mr. Farnsworth of New York University. Following the next committee meeting we expect to assemble returns on tests made since adoption of the standard test method.

Scoring. Since the yellowish-red series of chips is devised to confuse the protanope, the typical protanope has an even chance of calling each of the yellowish-red chips right or wrong. The deuteranope has an even chance of calling the purplish-red series right or wrong. Just as one expects, the majority of red-green blinds will make 9, 10, or 11 errors out of 20 presentations. Scores are recorded as protanope and deuteranope error scores. If a subject makes less than 10 percent error in either series, he is judged normal. If he makes errors of 35 through 65 percent, he is

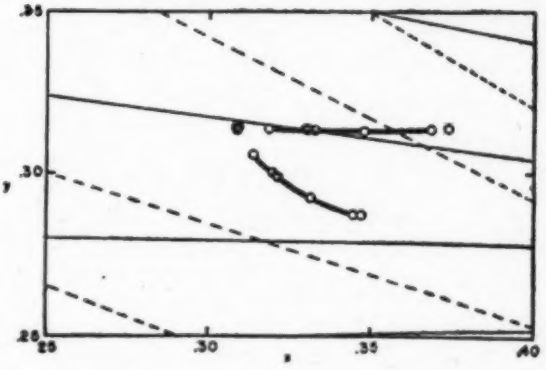

Fig. 3. Portion of I.C.I. (x, y) diagram. Continuous black lines present Pitt chromaticity confusion lines of protanope, dotted lines those of deuteranope. Circles represent measurements of selected samples of ISCC material, with heavy black line indicating materials used in the test described in this paper.

judged R-G blind. If errors lie between 10-35 percent in either or both series, he is judged deficient in R-G discrimination. If errors are greater than 65 percent, it is probable that the subject misunderstood instructions, confused right and left, confused redness with lightness-or-darkness for the protanope series, or is a malingerer. When the scores are definitely near to chance for one series only, then the subject is indicated as a protanope or deuteranope if near to a 50 percent score—protanomalous or deuteranomalous if near to a 25 percent score. If scores in both series run about the same then the subject is called "R-G blind, undetermined type" if near to 50 percent, the "R-G deficient, undetermined type" if nearer 25 percent.

Repeated tests on the same observer, tests with the same observer

on different sets of chips, on the same observer with different methods of test, have been made and results assembled by the committee.

Each subject is tested not only on the ISCC test but on the A.O., the fifth edition of Ishihara, and the Farnsworth-Munsell 100-hue test, as well as other tests that the cooperating members have available. Some have included Rabkin, the new Meyrowitz, Jennings. And on the Navy series, test results are available for the ISCC, A.O., and the test described by Dr. Hecht.

There is only very general agreement between various test results, each test showing peculiarities in a few cases. For example, in a comparison of about 60 deficient subjects tested on the A.O. and the ISCC, 4 high A.O. error scores show up in low ISCC error scores, but on the other hand, 7 low A.O. scores have high ISCC error scores, some of them very high, which would indicate that a number of R-G anomalous and I-G blind individuals are being passed by the A.O. test. There are peculiarities in all tests, and we need to find out the cause for each of them before the job is done.

We believe we have gone far enough so that new test material and several copies of the device should be thoroughly tried out on general populations and on populations in which the Armed Forces are interested, particularly the Air Forces with whose cooperation the work has so far been done.

The test is made of durable and permanent materials to exact colorimetric specifications; it is simple and rugged, fairly convenient in size, portable; it can be made self-administering; it includes its own standard daylight; on the basis of 40 judgments, subjects can be divided into three groups; the test cannot be memorized. All of these things, plus the fact that in a large majority of cases the test gives the results expected of it, make it seem a useful one to develop further. So far only the R-G discrimination portion of the test has been developed. Original plans call for the inclusion of Y-B and lightness discrimination.

This work has been the result of cooperation on the part of many ISCC delegates and members, and while we feel that this test can be made very useful, we are just as sure that other tests can be made useful also. Once we know just what color discriminations are required by the various branches of the Armed Services, then the most applicable tests can be selected out of present tests, or new ones developed for specific purposes.

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THE OPTOMETRIST, A POTENTIAL INFLATION VICTIM

In his January message to congress, President Roosevelt singled out the fixed income group as the worst sufferers in a period of gross inflation. This would of course include the optometrist. However, selecting a single or a small group of victims of inflation is like deciding who suffers most from an epidemic, the first victim it strikes or the last one brought down. In general it may be said that every group suffers as a result of gross inflation.

Rapidly rising prices will be found to strike malevolently at all

incomes fixed by usage, custom, law or contract. In this group the President named teachers, clergy, civil employees, minors and widows on fixed incomes, all dependents of men in service and those on pensions. To this list he might have added most salaried workers and professional people, as established fees are difficult to change, even in times of great stress.

When prices rise the earnings of optometrists fail completely to keep up with rising costs with the result that our real earnings are actually drastically reduced. Labor generally fares somewhat better and farmers and manufacturers who produce goods whose prices are rising fare even better still. Fees for professional services, on the other hand, are slow to change with the result that the professional groups suffer equally with the white-collar salary groups whom largely they serve.

We are told that since January, 1939, the actual weekly earnings of factory workers have risen almost 85 per cent, while the cost of living has gone up 26 per cent. According to the bureau of labor statistics the average real earnings of factory workers has risen more than 48 per cent since 1939. While optometrists are generally doing well today, it is safe to assume that the average gross income of the profession has not increased 85 per cent in the last five years, nor has the net income increased by any sum comparable to 45 per cent.

From the optometric standpoint, this is, in part, due to the fact that the fixed income group have also not had a comparable increase in income, and as has been said, this group are in large part the patients of optometrists and they are in no position to stand a marked increase in the professional charges they receive from us as professional men. Yet we all have suffered some price increases and if gross inflation is let to run its course the problem will become much more serious.

To date we find that the income increases of the fixed group and the professional group have been relatively small. In a period of gross inflation, however, prices rise so much faster than wages that all wage earners would soon find themselves in the same boat with the white collar and professional groups. Records show that governments have tried to enact legislation which would automatically increase the incomes of all wage earners as rapidly as the cost of living rose. Iceland has had such a law since 1939 decreeing that the basic pay of all labor, salary workers and pensioners shall automatically be increased monthly by the percentage which the index of the cost of living rises. It is found, however, that this legislation has actually served to aggravate the condition and cause more

inflation because it accentuates price rises in a vicious circle. Much the same thing happens when wages and prices seesaw in an uncontrolled effort to find equilibrium.

In a period of abnormal expansion such as World War II our only hope is through measures that seek to control prices and rises in the cost of living and thus counteract the inflationary influence of excess spending power in the hands of the public. Congress is confronted, as this is written, with two forms of anti-inflationary proposals. First the limited use of subsidies to control price rises, and second the use of higher federal taxes to reduce excess spending power. These proposals are our strongest hope of preventing rising prices from becoming grossly inflationary in this country.

At first this may seem far removed from the refracting room, but actually it is not. Widespread economic forces which undermine the strength of our nation are sure to adversely affect optometry as well and with the several important professional problems confronting us as optometrists we can ill afford financial set-backs which will retard the continued progress of our profession.

What congress will have to decide in the next few weeks is not whether there is to be inflation in this country or not. A 26 per cent rise in the cost of living in five years shows we already have some inflation now. Congress, in the action it takes on subsidies and taxes, must decide whether we are to take realistic steps toward inflation control or whether it will loose the inflationary forces now active and let them run unfettered and uncontrolled. How congress meets this challenge will determine the answer to this vital question and determine too, the future prosperity of our profession. CAREL C. KOCH

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

by J. Fred Andreae, Secretary

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

EASTERN AND CENTRAL STATES VISITED

The writer has just returned from a rather extensive trip during which a number of important Academy conferences were held. Of these, one of the most outstanding was a meeting of the New York Academy held at the McAlpin Hotel in New York City. The writer particularly

enjoyed the fine attendance of the New York Academy. We can well be proud of this chapter. Its members reflect, as do all other chapters, the highest professional type of optometrists. Their meetings are successful because there is a unity of thinking and planning for the future. We will all hear a great deal later on of the research now being sponsored by this group. Action was taken at this meeting to file applications of every chapter member for Fellowship in the American Academy of Optometry. Drs. Ryer and Hotaling arranged my stay in New York and I would like to thank them for the many courtesies which were extended to me.

Mrs. Wheelock and I next visited Springfield, Massachusetts, where several calls were made, then on to Southbridge for a lengthy discussion with Fellow Dr. Jerome Heather. One can always learn something from Dr. Heather as his work takes him to so many of our centers and from his numerous contacts he has a large fund of data from which to draw in making future plans for optometry. As usual he was willing to take time from his busy routine to help the Academy in any way he could. In Southbridge we were entertained at the country club and then driven to Boston.

Here the meeting of our Fellows was most enjoyable. Your President had an opportunity while in Boston to go over the future plans of the Academy with our Vice President, Dr. Curtis Wells, and with other of our Fellows who practice here. It is always good to see old friends and visit their busy offices.

The next city visited was Providence, Rhode Island, where the Academy is well represented. There was only time for a brief visit with each member, but it was enough to renew acquaintances and to learn that arrangements are in the making to enlarge our membership in this city.

We then traveled to Baltimore, where much of the material was turned over to our able Secretary, Dr. J. Fred Andreae. Here the Academy has an office in a busy downtown building. Much of the time was spent going over many reports and other matters pertaining to the Academy. Our office is well equipped and we accomplished a great deal in the short time permitted because of the efficient manner in which the office is organized. Much credit must be given Dr. Andreae for his untiring efforts in conducting this office. We very much enjoyed being guests at the Andreae home as they are perfect hosts.

A night trip brought us to Cleveland, where a meeting of Dr. R. M.

Hall, Chairman of the examining committee and Dr. D. G. Hummel, chairman of the papers and annual committee meeting was held. Work pertaining to these committees was promptly attended to.

We then visited their new offices where one can absorb the effect of the environment of being in beautiful yet practically planned rooms to carry on our work. A visit to the offices of these men makes one proud of being an optometrist.

While in Cleveland I was informed that all members of the Cleveland Chapter will make application for Fellowship.

From Cleveland we journeyed to Dayton. Here again much enjoyment was had in making calls on the optometrists of this busy city. The chapter plans were explained to them, and I have every reason to believe that in the near future a Dayton Chapter will be announced.

An evening was enjoyed with the army personnel at Wright Field. Considerable information was gained through this contact and I'm sure the officers at the field were interested in the viewpoint of optometry and their expressions of future cooperation were most encouraging.

The next city visited was St. Louis, where we called to accept an invitation for a conference with one of the prominent ophthalmologists of that city. Problems confronting both professions were discussed and from this meeting will come a better understanding of all those interested in the analysis of correction of visual problems. Part of the day was also spent with the personnel of the navy where an explanation of our work in the past and our plans for the future was well received.

Before returning home to Des Moines we next visited Kansas City, where a conference was held with several of our committee members, and where we saw some exceptionally fine work done by Dr. William Locke in fitting contact glasses.

To summarize, the tour was very successful because of the contacts made with our membership and with groups of optometrists who were eager to have the chapter plans explained to them which will result in an increase in our membership.

In addition, much good work was done in bringing about a better understanding between the optometrists, the army, the navy, and opthalmology.

In each city visited we found optometrists busy and intensely interested in their work. The trend toward professionalism grows stronger

on every hand and much progress is being made in this direction. The American Academy of Optometry holds an enviable position in the future of our profession and in its post war planning.

ARTHUR P. WHEELOCK.

ANNUAL MEETING OF IOWA ACADEMY OF OPTOMETRY

About thirty-five members of the Iowa Academy of Optometry met at dinner at the Kirkwood Hotel, April 12th, to conduct the affairs and to hear a very fine talk given by Dr. Louis W. Palm, Kansas City. Dr. Palm, a fellow in the American Academy, spoke on Optometry's overlooked opportunities, patient control, and also gave a fine explanation for the basic reasons of the Academy.

New applications were accepted, election of officers followed by electing Dr. Ralph Hays, Harlan, Iowa, President and Dr. Norman Kunath, Eldora, Iowa, Secretary. Also plans for the coming year's activity were discussed.

BOOK NOTICES AND REVIEWS

Books received are acknowledged by notices in this department. Special selections will be made for more extensive review in the interest of our readers as space permits.

PERSONALITY AND THE BEHAVIOR DISORDERS. J. McV. Hunt, Editor. Two volumes, 1242 pp.; $10.00. The Ronald Press Co., 15 E. 26th St. New York, N. Y.

Alexis Carrel once said that the scientific world needed to integrate some of the investigations that had been done by its various workers. One might infer that he believed we should pause occasionally in our busy but narrow investigations and have various specialists get together, pool their scientific findings and, momentarily at least, break out of their sharply defined specialist cages.

This work pools and brings up to date the resources of the leaders in the investigation of personality, behavior patterns and behavior disorders. Thirty-five chapters by one or more authorities each make up its two volumes. The result is an outstanding achievement. By fostering the cross-disciplinary approach to their problems, the authors clear some of the obstructions that have slowed progress in this field. The conventional boundaries between sciences are largely ignored, so that while the details of theory and research are known to only small groups of specialists, we have here the spectacle of forty scientific lions lying down together to rise with a truly notable work, integrating the work of all.

Not a symposium, the work permits each author to present his particular subfield with its tactics and strategy; psychoanalysis, for example, is not presented as a doctrine, but several authors who are analysts themselves describe psychoanalysis as a *clinical method of research.*

The editor states that "personality" is perhaps not a fortunate selection of terms; he prefers *Personology,* were that term in current use, to describe the *scientific study of persons;* perhaps it is wise to point out here that certain patterns and reactions are summoned up in most of us —not necessarily the same ones—by the term *personality* that would not in every instance be compatible with this type of work.

This is a scientific study of the actions, reactions and behavior, both normal and abnormal, of different individuals under varying circumstances. As a reference work for mature clinicians and students beyond the elementary level, it would be difficult to recommend it too highly. No professional man who deals with the public should be without it or its equivalent.

JAMES O. BAXTER, JR.

ANNOUNCEMENTS

VISUAL SKILLS COURSE AT PENNSYLVANIA STATE COLLEGE

S. Donald Melville of the Reading Clinic staff, will offer Psychology 473, *Psycho-physiology of Vision,* for a six-day period beginning at 9:00 a. m. Monday morning, June 5. Lectures and demonstrations on the taking of visual skills for screening and preliminary visual analysis purposes will be given daily. Each student will be required to complete a minimum of 18 laboratory hours with cases admitted to the Reading Clinic. This course is being offered to meet the needs of vision specialists, visual training technicians, school psychologists, teachers, and nurses. Since this is a laboratory course, advance registration is necessary.

This course will be offered one week preceding those offered by Dr. Ewalt and Dr. Bing, June 12 to June 22, inclusive. This course will be repeated by E. A. Betts and S. D. Melville during August (beginning Monday morning, August 7), at which time the course may be taken for one, two, or three weeks.

Those interested in taking any of such special courses on vision should apply to Miss Betty J. Haugh, Reading Clinic Secretary, Room 8, Burrowes Education Building, State College, Pennsylvania.

SUCCESSFUL MIDDLE ATLANTIC EDUCATIONAL CONGRESS

The four day Middle Atlantic Educational Congress has just been concluded. This annual meeting, held in Pittsburgh, was the largest Congress held so far, and the optometrists present were very pleased with the splendid program.

In spite of the fact that the Congress opened on Easter Sunday, the Gold Room of the Roosevelt was filled for Dr. Skeffington and Dr. Renshaw. Optometrists from ten states and Canada came to this symposium on Myopia and they did hear and learn and work on all aspects of this tremendously important subject for four days.

Dr. Renshaw, who originally was scheduled for three days at the Congress, had to curtail his program and be back at the University Tuesday. He compensated by presenting his "Tachistoscopic Studies and Methods" on Monday instead of Tuesday. The Tachistoscope and the new Renshaw Disparator vied with each other for the attention of the optometrists present. The classes of Dr. Marguerite Thoma Eberl, Dr. F. Milton Hathaway, and Dr. H. Ward Ewalt, Jr., were filled and it was a great satisfaction to the Pittbsurgh Optometric Society which sponsors the Middle Atlantic Congress to hear the enthusiastic reports from all who attended these classes. The goal this year was to see that everyone had practical answers to carry back home. From the copious notes in evidence, this goal was attained.

The Beta Sigma Kappa table at the luncheon on Monday held the usual overflowing group who enjoy getting together for both exchange of ideas and reminiscing. The Omega Deltas had a table for the first time this year and organized the Pennsylvania members present. It was an honor to have Dr. E. B. Alexander this year and at a supper meeting he met with Study Group men promising interesting plans for such groups in the future. Dr. Alexander was guest speaker at the Fellowship Dinner Tuesday evening, April 11, after which was held one of the best open forum discussions we have heard in Pittsburgh. Dr. Westland and Dr. Hathaway conducted classes for technicians on the technique of Visual Skills. It is fine to see an increasing number of orthoptic technicians interested in this procedure.

SPECIAL REPORTS

REFRACTIONS FOR ARMY MILITARY PERSONNEL

For more than a year optometrists in private practice and in the armed services have been demanding adequate recognition when serving with the armed forces. The Navy has shown a tendency to cooperate, and as a result a number of optometrists have been commissioned in this branch of the service. A still larger group of optometrists have been given non-commissioned ratings and are doing ocular refractions in naval hospitals and infirmaries.

In the Army the situation has been somewhat different. Here a number of optometrists have been assigned to refractive work in Army hospitals, yet these men have not been commissioned as optometric refractionists, despite the fact that a large number of optometrists hold commissions in the specialized services doing non-optometric work.

In general, it must be admtited that, to date at least, the Army has failed to recognize the optometrist by commissioning him to perform his proper work as a visual specialist.

During March A. O. A. officials conferred in Washington with top-ranking military authorities and it was believed that as the result of this conference some adjustment of this awkward situation would be made and it was also hoped that as a result of these conferences Army optometric refractionists would be granted the recognition they seek, i.e., commissions.

Readers may now judge for themselves the success of these conferences as on April 12, 1944, the following circular was issued dealing with this subject:

CIRCULAR No. 143.

WAR DEPARTMENT
Washington, D. C.
12 April, 1944

III—OPTOMETRISTS. 1. In view of the large number of refractions to be performed for military personnel, the services of qualified optometrists to assist in the performance of these refractions will be utilized to the extent that such personnel may be available. The policy of having optometrists perform refractions under the supervision of medical officers will be continued except in very unusual circumstances such as a situation where a medical officer cannot be in constant attendance. It will be the responsibility of commanding generals of service commands, ports of embarkation within the continental United States, Army Air Forces commands and Air Forces operating in the continental limits of the United States, and theaters of operations to take steps as soon as practicable to insure the competency of optometrists performing these duties in installations within their commands.

2. a. Optometrists performing refractions for military personnel should be—
(1) Licensed in the State in which registered, and
(2) Graduates of an approved school of optometry.
b. In the most exceptional cases only, either or both of the requirements in *a*

above may be waived by the supervising medical officer with the approval of the commanders mentioned in paragraph 1. In any instance where there is a question as to whether the individual possesses the necessary qualifications, the matter will be referred for decision to the Office of The Surgeon General, Washington 25, D. C.

3. The foregoing instructions relate to the use of optometrists in both the zone of interior and in oversea theaters of operation. Because of the fact that the number of optometrists presently available in the Army is probably inadequate to insure such personnel being available to all hospital installations, it will be the responsibility of the commanders mentioned in paragraph *1* to dispose of available personnel in such manner as to insure their being assigned to installations which have the greatest need for their services.

4. The particular attention of theater commanders is directed to the fact that under existing Tables of Organization and Equipment there is a deficiency of refracting facilities in hospital installations normally functioning within combat or Army zones, which has in some instances resulted in the evacuation of personnel to communications zone installations and their hospitalization in instances where spectacles only are required. Every effort should be made to avoid evacuation of such personnel and their treatment as other than out-patients. This will require, in some instances, the special assignment of personnel for performing refractions within combat zones and a close coordination between facilities for performing refractions and facilities available for the initial issuance or replacement of spectacles.

ABSTRACTS

A department in which will appear abstracts of the literature of optometry, ophthalmology and applied optics. These will be classified according to the following list, although contributions to all sections will not necessarily appear in each issue.

1. Ocular Refraction.
2. Physiological Optics and Color Vision.
3. Ocular Muscles.
4. Orthoptics and Reading.
5. Anatomy, Histology and Embryology.
6. Ocular and General Pathology.
7. Ophthalmic Lenses and Material.
8. Instruments.
9. Hygiene and Illumination.
10. Applied and Physical Optics.
11. Education, Sociology and Economics.
12. Miscellaneous.

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9. HYGIENE AND ILLUMINATION

BRIGHTNESS IS OMNIPOTENT IN SEEING. M. Luckiesh, Columbia Optometrist, 1944, 18, 69, 2-3.

The author points out that the average brightness of common areas of landscapes is high in comparison to the brightness levels, as measured by footlamberts, under which we frequently force our eyes to work. He further points out that these high levels are harmless and suggests our raising the levels of brightness and illumination for our average tasks.

C. C. K.

EYE PROTECTION AND SAFETY IN SHIP BUILDING. J. J. McCaffery, Journal of the American Optometric Association, 1943, 14, 9, 251-253.

"Today, the modern naval war worker dons protective equipment when he starts out to battle with his old time enemy—'accidents.' Each

piece of equipment has an important mission to fulfill and can be relied upon to do its job. The type of safety equipment issued to shore establishment employees is procured under rigid specification which insures quality equipment of satisfactory design, affording maximum comfort and service to the wearer. Products of inferior quality usually lend a sense of false security and generally prove to be poor economy. In the interest of health and safety, we must adhere to the policy that the Industrial Safety Program will be best served by the purchase of equipment from reputable and experienced manufacturers who met requirements and specification."

McCaffery describes in some detail clippers goggles, face shields, regular workers goggles, rubber frame goggles, hot workers goggles, hand shields, helmets and various other safety appliances used in naval ship building to protect the health of the worker and to also protect him from accident. A. V. F.

LIGHTING INFLUENCES EVOLUTION OF THE EYE. S. G. Hibbon, Western Optical World, 1942, 30, 11, 457-458.

In the slow cycles of evolution it requires many years to effect lasting changes in the human body. After generations of easy visual tasks under Nature's illumination, we still have enjoyed reasonably good vision even though during the past several hundred years our lighting conditions were terrible. Possibly the accumulating defects of the seeing organs may now be a penance that we are paying for the carelessness of our recent ancestors. Possibly, and this is the disturbing thought—we may face a century or two of still graver eyesight deficiencies before actual improvements in artificial lighting are sufficiently general or have been used sufficiently long to counteract the recently multiplying loads that we are placing on our eyes. A. V. F.

EYE PROTECTION IN WAR INDUSTRY. J. H. Meikle; Pennsylvania Optometrist, 1943, 4, 1, 1-3.

"To sum up the requirements for adequate and reliable eye protection for war workers, the following facts should be considered: (1) Many workers in war industries today are not accustomed to industrial environments and do not appreciate the possibilities of eye injuries. They must be fully informed of these possibilities and supplied with suitable protective devices. (2) A sincere and honest appeal must be made to obtain the cooperation of workers in wearing their eye protective devices

once they have been supplied. This appeal should be supplemented by the setting of a good example by persons working in a supervisory capacity. Because the time lost through accidents in war industries has reached enormous proportions the Army has undertaken a safety program on a nationwide basis. The program has been so set up as to offer industry every service in combating its accident problems. Any effort that is put forth to bring about a reduction in eye accidents will certainly be welcomed as a splendid contribution." T. O. B.

LIGHT FOR TOMORROW'S WORLD. H. F. Barnes, Better Light—Better Sight News, 1943, 12, 4, 2.

"Millions of war workers who are making the sinews of war—in well-lighted plants—will have spent months and perhaps years under high levels of illumination—and this will unquestionably affect their desire for light in peacetime in homes, in stores, in schools, in offices. The whole relationship of light to increased production and the lowering of manufacturing costs, will unquestionably be carried into the postwar period, where, in the competition for sales, low and still lower costs will be the watchword of the day. In most industries, the techniques that have improved quality, increased production and lowered costs will reflect the war's progress in peacetime models—and lamps and lighting will be no exception." T. O. B.

MEDICAL FIRST AID. J. M. Carlisle, Industrial Medicine, 1943, 12, 2.

The author discusses ocular injuries in industry. Carlisle advises that when an irritant chemical has entered the eye, the first objective should be the immediate removal of the offending agent. This can best be accomplished by immediate irrigation of the eye with copious quantities of clean running water. The patient should then be sent directly to the medical department. Foreign bodies entering the eye, if not having chemically irritant properties or not producing a burning sensation, should not be touched at the scene, but the patient should be sent directly to the medical department. If there is an irritant reaction or a burning sensation from the material, the patient's eyes should be flushed with water immediately at the site of the accident. Traumatic injuries should not be touched at the site of the injury but the patient should be sent directly to the medical department. T. O. B

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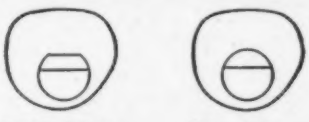

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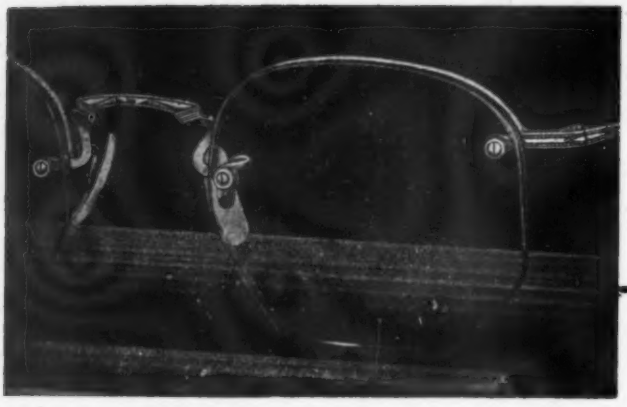

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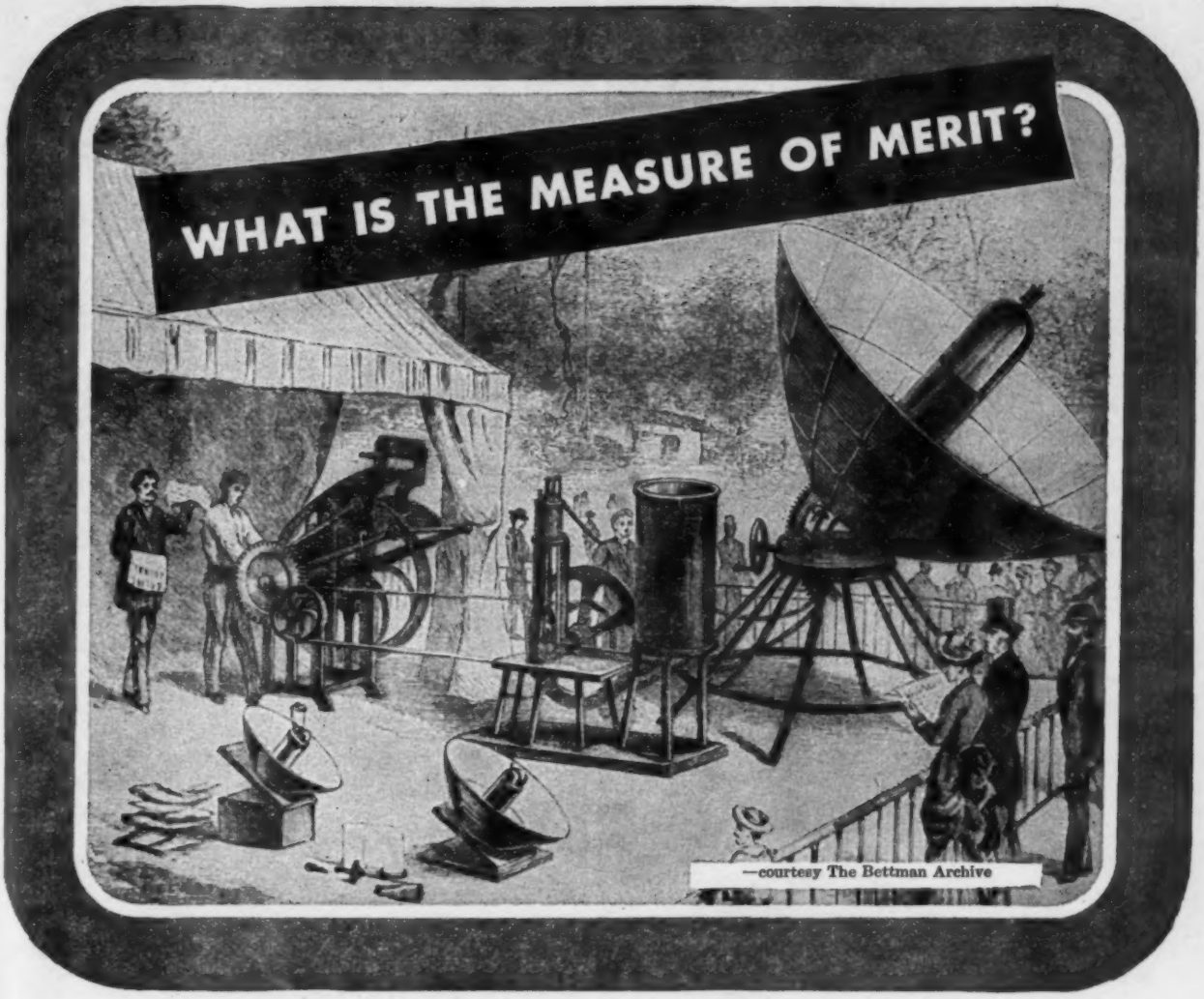

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